DEPR:
Examples 3a-3h were performed exactly as examples 2m-2p except that the **Superba** set polypropylene yarn was tufted at 22 osy, two different pH levels for the bath were used and the XP-4-50 and SR-300 stain resist compounds were compared. Example 3i was tested as a control. Example 3i was made with the 22 osy **Superba** set polypropylene yarn, was treated in the dye bath simulation, but was not treated to add either fluorochemical or stain resist compound. The results are reported in Table 3.

DEPR:
Examples 4a-4p were performed to observe the effect of the pH of the aqueous dispersion of fluorochemical. The carpet sample pieces used in these examples were made with the nylon 6,6 yarn described above which was **Superba** set also as described above. The yarn was tufted to give a density of 35 osy. The carpet sample pieces were all treated in the dye bath simulation method described above. A fluorochemical was then applied by the immersion method described above. The liquor for the fluorochemical application included 0.6% of the NRD372 composition described above and urea sulfate to adjust the pH to the level noted below. The balance of the liquor was water. The pieces were steamed, rinsed, extracted and dried as described above. The carpet sample pieces were then tested in the oil repellency, water repellency, and water/alcohol repellency tests described above. The pieces were also tested to determine the level of fluorine as described above. The results are reported in Table 4.

DEPR:
Examples 5a-5p were performed and tested exactly the same as Examples 4a-4p with the exception that the nylon 6 yarn described above was used in place of the nylon 6,6 yarn. The nylon 6 yarn was **Superba** set and was tufted at 25.5 osy. The results are in Table 5.

DEPR:
Examples 10a-10i were performed exactly the same as examples 8a-8i with the exception that the **Superba** set nylon 6 yarn described above tufted at 25.5 osy was used instead of the nylon 6,6. The results of the tests on these samples are in shown Table 10.

DEPR:
Examples 11a-11f were performed the same as examples 9a-9f, with the one exception that the **Superba** set nylon 6 yarn described above tufted at 25.5 osy was used instead of the nylon 6,6. The results of the tests on these samples are in shown Table 11.

DEPR:

Examples 16a-16x were performed the same as examples 12a-12x with the sole exception that the carpet used was made from nylon 6,6 **Superba** set yarn tufted at 35 osy. The results of the tests are shown in Table 16. The results for these examples with nylon 6,6 are similar to those found in Table 12 for nylon 6.

DEPR:
In the following examples, the carpet used was all made from either a DuPont Type 1150 nylon 6,6 filament yarn or a 1450 type polypropylene yarn. The nylon yarn was **Superba** heat set and tufted at 25.5 osy. The polypropylene yarn was also **Superba** heat set and tufted at 34.3 osy. The carpet included a latex adhesive coat and a polypropylene secondary backing both applied by conventional means. As is typical, the carpet was made in a roll about 12 feet wide.

DETL:
TABLE 1 _____ Fiber FX XP- H.sub.2 O/ ppm
No. Type 1367 T232D 4-50 Oil H.sub.2 O Alc F
_____ 1a N6 X P P P 367 **Suessen** 1b X X P P F 128 1c X P P P 416 1d X X P P P 320 1e N6 X P P P 553 **Superba** 1f X X P P P 321 1g X P P P 389 1h X X P P P 309 1i N6,6 X P P P 267 **Suessen** 1j X X P P F 104 1k X P P P 384 1l X X P P P 272 1m N6,6 X P P P 473 **Superba** 1n X X P P F 126 1o X P P P 397 1p X X P P P 289

_____

DETL:
TABLE 2 _____ Fiber FX XP- H.sub.2 O/ ppm
No. Type 1367 T232D 4-50 Oil H.sub.2 O Alc F
_____ 2a PET X P P P 124 **Superba** 2b X X P P F 111 2c X P P P 304 2d X X P P P 224 2e PET 837 X P P P 166 2f X X P P P 861 2g X P P P 346 2h X X P P P 253 2i PET 804 X P P P 126 2j X X P P F 76 2k X P P P 212 2l X X P P P 216 2m PP X F P P 135 **Superba** 2n X X P P F 229 2o X F P P 90 2p X X P P P 313 _____

DOCUMENT-IDENTIFIER: US 6242091 B1
TITLE: Yarns comprised of bulked continuous filaments of poly(trimethylene terephthalate)

DEPR:
Carpets made from the BCF yarns of this invention may be made in any of the manners known to those skilled in the art. Typically, a number of yarns are cable twisted together (about 3.5 to 6.5 twists per inch) and heat set (about 270.degree. to 290.degree. F.) in a device such as an autoclave, **Suessen or Superba**(R) and then tufted into a primary backing. Latex adhesive and a secondary backing are then applied. Cut pile style carpets having a pile height between about 0.25 to 1 inches or loop pile style carpets having a pile height between about 0.125 to 0.375 inches can be made with these BCF yarns. Typical carpet weights are between about 25 to 90 ounces per square yard.

DOCUMENT-IDENTIFIER: US 6098392 A
TITLE: Process for making multicolored yarns and the product thereof

DEPR:
For cut-pile carpets, the cable-twisted yarn may then be heat-treated in its twisted condition by passing the yarn through a continuous heat-setting machine known as a "**Superba**" which treats the yarn with pressurized saturated steam to heat-set the twist. Another method involves passing the yarn through a continuous heat-setting machine known as a "**Suessen**" which treats the yarn with dry heat to heat-set the twist. The cable-twisted, heat-set yarns are then needled into a carpet backing material as loops which are then cut and sheared to form carpet pile tufts. For loop-pile carpets, the cable-twisted yarns may be heat-treated if such a step is commercially practical, but this is not necessary. Also, for loop-pile carpets, the yarns are needled through the carpet backing as loops, but the loops are not cut.

DEPR:
In this Example, a yarn package of BCF singles yarn produced from above Example 8 and having a russet color and a 600 denier was placed in the yarn supply bucket of the cable-twister and used as one bucket yarn. A yarn package of BCF singles yarn produced from above Example 3 and having a Puritan Gray color and a 600 denier was also placed in the yarn supply bucket of the cable-twister and used as the second bucket yarn. A yarn package of BCF singles yarn produced from above Example 6 and having an Egg Shell color and a 600 denier was placed on the creel and used as one creel yarn. A yarn package of BCF singles yarn produced from above Example 10 and having a Medium Teal color and a 600 denier was placed on the creel and used as the second creel yarn. The first and second creel yarns were co-twisted together to form a creel component yarn, and the first and second buckets yarns were co-twisted together to form a bucket component yarn. The creel and bucket component yarns were cable-twisted together at a twist level of 4.5 turns per inch (tpi). The resulting cable-twisted yarn was then subjected to heat-treating process with pressurized saturated steam using a "**Superba**" machine at a temperature of 135-140.degree. C. for a time of 1-2 minutes in order to heat-set the cable-twist in the yarn. The resulting heat-set, cable-twisted yarn exhibited vivid color separation from its four singles yarns. This resulting cable-twisted yarn was tufted into a carpet using a 1/10 inch tufting gauge machine to form a cut-pile carpet having a pile height of 5/8 inches.

DOCUMENT-IDENTIFIER: US 5939166 A
TITLE: Moisture stable tuftstring carpet

DEPR:
If a ply-twisted multifilament yarn is constructed, it may then be "textured" by passing the yarn through a stuffer box, where the yarn is compressed and individual filaments are folded and bent. The yarn may also be heat-treated to set the twist in the yarn. This heat-setting of the twist is done if the yarn is intended for use in a cut-pile carpet structure. These techniques are also well known in the art. For example, the yarn may pass through a "**Superba**" continuous heat-setting machine which treats the yarn with pressurized saturated steam or a "**Suessen**" machine which treats the yarn with dry heat. If the yarn is a solution dyed nylon yarn, treating it on the "**Suessen**" machine will impart stain resist and bleach resist properties not acquired by treating the yarn on the "**Superba**" machine. These yarns may then be used to construct the tuftstring carpet assembly in accordance with the methods described herein.

DOCUMENT-IDENTIFIER: US 5520962 A
TITLE: Method and composition for increasing repellency on carpet and carpet yarn

BSPR:
The extruded fibers can be made into yarn by various means. Most preferably, the nylon yarn is a bulk continuous filament yarn which is heat set by conventional means, such as the **Superba or the Suessen** method. Alternatively, the yarn can be a staple spun yarn. Also, it is preferred that the yarn is not pre-treated with a fluorochemical by the yarn manufacturer.

DEPR:
Where the example refers to a nylon 6,6 filament yarn, this is a **Suessen** set type 1150 yarn from DuPont.

DEPR:
Where the example refers to a **Superba** set yarn, this is a yarn that has been heat set with saturated steam under pressure in a continuous heat setting unit.

DEPR:
Where the example refers to a **Suessen** set yarn, this is a yarn that has been heat set with super heated steam under pressure in a continuous heat setting unit.

DEPR:
Examples 1a-1p were performed to demonstrate the invention on nylon 6 and nylon 6,6 of carpet face fiber. The yarn in examples 1a-1h was the nylon 6 yarn described above. In examples 1a-1d, the yarn was **Suessen** set and tufted at 32 osy. In examples 1e-1h, the yarn was **Superba** set and was tufted at 25.5 osy. The yarn in examples 1i-1 p was the nylon 6,6 yarn described above. In examples 1i-1l, the yarn was **Suessen** set and was tufted at 30.3 osy. In examples 1m-1p, the yarn was **Superba** set and was tufted at 35 osy.

DEPR:
Examples 2a-2p were performed exactly as examples 1a-1p except that different types of face fibers were used. In examples 2a-2d, the yarn was as the **Superba** set PET filament described above and was tufted at 33 osy. In examples 2e-h, the yarn was the carrierless polyester staple described above and was tufted at 34 osy. In examples 2i-2l, the yarn was the carrier polyester staple from Hoechst Celanese described above and was tufted at 40 osy. In examples 2m-2p, the yarn was the **Superba** set polypropylene filament produced by Shaw Industries, Inc. described above tufted at 26 osy. The results are reported in Table 2.

DOCUMENT-IDENTIFIER: US 5032333 A
TITLE: One-line interlacing of bulked continuous filament yarns and low-melting **binder fibers**

TTL:
One-line interlacing of bulked continuous filament yarns and low-melting **binder fibers**

ABPL:
This invention relates to a process for combining a low melting **binder fiber** with a continuous filament base yarn to form a composite yarn having good bulk and a high level of interlace. More particularly, the process involves bulking a continuous filament yarn, combining it with the low-melting **binder fiber,** interlacing the combined yarn, and then fixing the interlace.

BSPR:
This invention relates to a process for producing bulked, interlaced yarns containing low-melting **binder fibers**. More specifically, the invention pertains to a method for introducing low-melting filaments into a high-speed running threadline of bulked continuous filament yarn and interlacing the two components to achieve a high degree of intermingling without a tight nodal structure or loopiness.

BSPR:
The use of heat-activated **binder fibers** in carpet yarns to improve retention of tuft identity, resulting in increased wear resistance and carpet life, is disclosed in the published patent applications Hackler, PCT-WO 88/03969 and Watt & Fowler GB 2205116-A. The referenced published applications teach that bulked continuous filament (BCF) yarns containing low-melting binder filament yarns may be produced using conventional manufacturing methods but do not disclose or give examples as to where in the process or how the binder filament is incorporated into and intermingled with the base continuous filament yarn.

BSPR:
Methods suggested by the prior art have various shortcomings. The binder and BCF yarns may be ply-twisted together in the carpet mill prior to tufting; however this will lead to binding of individual plies rather than binding the filaments within each tuft. An additional disadvantage of using this method is that the fiber producer is unable to ensure the quality of tuft bonding in the final carpet since the process for incorporating the binder filaments in the yarn is carried out in the carpet mill. A further drawback of this method is that when the binder filaments are twisted together with the BCF yarn, the

binder filaments are essentially wrapped around the outside of the BCF yarn bundle. When these yarns are heatset with moist heat as in a **Superba** heat-setting apparatus (where typically 6-24 twisted ends are heat-set simultaneously on a moving belt) or in an autoclave (where yarn skeins are used), the ends may stick together to an unacceptable degree. Such sticking can be a particular problem for a **Superba** process as the line has to be shut down whenever the bundles are stuck together.

BSPR:
The binder filaments may also be added prior to drawing the base continuous yarn and the two yarns co-bulked and interlaced in a process similar to that disclosed in De Howitt, U.S. Pat. No. 4,612,150. However, in this case the **binder fiber** melts on the hot rolls, and the process becomes inoperable. Although the temperature of the hot rolls may be reduced to avoid melting of the **binder fiber,** in such event inadequate carpet bulk is obtained.

BSPR:
Another option is to add the **binder fiber** after the heated draw rolls but before the bulking/interlacing jet. However, residual heat in the base fiber coming off the heated draw rolls and the heat in the bulking fluid used in the jet may be sufficient to soften and melt the **binder fiber** and cause it to break intermittently along the length of the base continuous filament yarn. The broken filaments cause severe housekeeping problems in the areas of both the BCF machine and the twisting equipment. Again, the bulking temperature may be reduced to eliminate breaks, but this tends to result in insufficient bulk.
Yet another option is to add the **binder fibers** to the continuous filament yarn after it passes through the bulking/interlacing jet. However, since the BCF yarn is well-interlaced at this point, it is not possible to achieve optimum intermingling of the BCF and binder filaments. This results in filament breaks in downstream mill operations such as twisting, knit-de-knit processing, or tufting.

BSPR:
The process of the current invention overcomes the above-mentioned problems by incorporating **binder fibers** into a base continuous filament yarn in a manner which maximizes the bulk and degree of intermingling of the two components and eliminates filament breaks in the low-melting component. A further advantage of the present invention is that the process may be run at high speeds, in excess of 2000 yd/minute (1829 m/minute) with excellent bulk and interlace in the final two-component yarn.

BSPR:
Examples of suitable continuous filament base yarns for use in this process are those spun from polymers such as nylon 6, nylon 6,6, polyproplene, and polyester. The low melting binder yarns are typically made using random

copolymers of the polymer type found in the base yarns and are chosen such that the **binder fibers** melt at temperatures used for heatsetting carpet yarns by conventional techniques. Such heat-setting temperatures are typically about 130.degree.-140.degree. C. for **Superba** steam heat-setting equipment and about 190.degree.-205.degree. C. for **Suessen** dry heat-setting.

DEPR:
The bulking step of this process involves crimping or otherwise adding texture to the filaments of the continuous yarn bundle in order to form a bulked yarn having little or no interlace. Bulking processes of this general type are disclosed in Breen and Lauterbach, U.S. Pat. No. 3,854,177, whose disclosure is incorporated herein by reference. Interlace is to be minimized in order to more effectively combine and then, at a later stage, interlace together the filaments of the continuous base yarn with those of the low-melting **binder fiber**. The bulking step is most effectively performed immediately following drawing of the freshly-spun continuous filament yarn. When a hot-draw process is used, the yarn will be heated during drawing, and the elevated temperature will assist in imparting adequate bulk to the fiber. It has been found that an effective amount of bulk can be added to the yarn with little or no interlace by impinging the yarn with a fluid stream within a single-impingement bulking jet. A particularly useful jet of this type is the dual-impingement jet described in Coon, U.S. Pat. No. 3,525,134, the disclosure of which is herein incorporated by reference, where one of the fluid orifices has been plugged, rendering it inoperative. When such a jet is used, the bulk developed in the jet should be set as further described below.

DEPR:
The bulked continuous filament base yarn is then combined with the low-melting **binder fiber** using conventional methods, and the composite yarn is then interlaced. As used herein the term interlacing refers to extensive entanglement or comingling of the filaments which make up the yarn bundle. Accordingly, the interlacing step of this invention should effectively comingle the filaments of the bulked base yarn with those of the low-melting **binder fiber**. This can be accomplished using conventional interlacing methods, such as impinging the yarn with multiple fluid streams in a multiple-impingement jet. The dual-impingement jets described in Coon (without the plugging modification described for the bulking step above) are particularly useful.

DEPR:
Composite yarns made by this process exhibit good bulk and interlace and can be heat-set in **Superba** (or other types of) moist heat-setting equipment without an unacceptable number of line stoppages caused by filaments sticking to one another as described in the Background section above. When tufted into carpets following heat-setting, the carpets exhibit excellent tuft tip definition and good wear retention.

CLPR:
3. The process of claim 2 wherein the low melting **binder fiber** is made using a random copolymer of the polymer from which the continuous fiber is made.

CLPR:
4. The process of claim 3 wherein the continuous filament yarn is made using nylon 6,6 and the low-melting **binder fiber** is a random copolymer of nylon 6 and nylon 6,6.